

Appl. No. 10/808,193

RECEIVED
CENTRAL FAX CENTER

JAN 22 2007

AMENDMENT TO THE CLAIMS

This listing of the claims will replace all prior versions, and listings, of claims in the application.

What Is Claimed Is:

1. (Currently Amended) A method for forming a semiconductor device comprising the steps of:

depositing a monoatomic film including a metal on a base by using a metal source including a compound containing said metal and no oxygen; [[and]]

depositing a metal oxide film including oxide of said metal on said monoatomic film by using a CVD technique; and

before said monoatomic film depositing step, the step of supplying oxidizing gas onto a surface of said base.

2. (Canceled)

3. (Currently Amended) The method according to claim [[2]] 1, wherein said oxidizing gas includes heated H₂O.

4. (Currently Amended) The method according to claim [[2]] 1, wherein said oxidizing gas includes at least one gas selected from the group consisting O₂, active oxygen, ozone, and N₂O.

Appl. No. 10/808,193

5. (Previously Presented) The method according claim 1, further comprising, before said monoatomic film depositing step, the step of supplying hydrofluoric acid onto a surface of said base.

6. (Original) The method according to claim 1, wherein said metal source includes at least one said compound selected from the group consisting of $TaCl_5$, TaF_5 and $Ta(N(C_2H_5)_2)_3$, and said metal oxide film is tantalum oxide.

7. (Currently Amended) The method according to claim 1, wherein said metal source includes $Al(CH_3)_3$, and said metal oxide is titanium aluminum oxide.

8. (Original) The method according to claim 1, wherein said metal source includes TiC_4 or $Ti(N(CH_3)_2)_4$ and said metal oxide is titanium oxide.

9. (Original) The method according to claim 1, wherein said metal source includes at least one said compound selected from the group consisting of $Hf(NCH_3)_2)_4$, $Hf(N(C_2H_5)(CH_3))_4$ and $Hf(C_2H_5)_2)_4$, and said metal oxide is hafnium oxide.

10. (Original) The method according to claim 1, wherein said metal source includes at least one said compound selected from the group consisting of $NbCl_5$, NbF_5 and $Nb(N(C_2H_5)_2)_3$, and said metal oxide is niobium oxide.

Appl. No. 10/808,193

11. (Previously Presented) The method according to claim 1, further comprising, between said monoatomic film depositing step and said metal oxide film depositing step, the step of supplying oxidizing gas onto a surface of said monoatomic film.

12. (Previously Presented) The method according to claim 1, wherein said base is either silicon substrate, polysilicon film, silicon nitride film or a metallic film.

13. (Original) The method according to claim 1, further comprising the step of forming a conductive film on said metal oxide film, wherein said steps are used for forming a capacitor including said base as a bottom electrode, said metal oxide film as a capacitor insulation film, and said conductive film as a top electrode.

14. (Currently Amended) A method for forming a semiconductor device comprising:

depositing a monoatomic film including a metal on a base in an oxygen-free environment; and

depositing a metal oxide film including an oxide of the metal on the monoatomic film using a CVD technique; and

before said monoatomic film depositing step, the step of supplying oxidizing gas onto a surface of said base.

15. (Previously Presented) The method of claim 14, wherein the semiconductor device is adapted to function as a capacitor.

Appl. No. 10/808,193

16. (Currently Amended) The method of claim 14, wherein the depositing of the monoatomic film including the metal includes using a metal source including a compound containing the metal.

17. (Currently Amended) A semiconductor device formed by a method, the method comprising:

depositing a monoatomic film including a metal on a base in an oxygen-free environment; and

depositing a metal oxide film including an oxide of the metal on the monoatomic film using a CVD technique; and

before said monoatomic film depositing step, the step of supplying oxidizing gas onto a surface of said base.

18. (Previously Presented) The semiconductor device of claim 17, wherein the semiconductor device is adapted to function as a capacitor.

19. (Currently Amended) A method to form a semiconductor device comprising the steps of:

depositing a monoatomic seed layer containing a metal on a base by using a metal source including a compound containing said metal and no oxygen, said deposition done via an atomic layer deposition (ALD) technique; and

introducing an oxygen source to convert said monoatomic seed layer containing metal to a monoatomic seed layer containing a metal oxide and depositing a film of the same metal oxide on said monoatomic seed layer via a CVD technique; and

Appl. No. 10/808,193

before said monoatomic seed layer depositing step, the step of supplying oxidizing gas onto a surface of said base.

20. (Previously Presented) The method of claim 19, wherein said metal source includes at least one said compound selected from the group consisting of $TaCl_5$, TaF_5 and $Ta(N(C_2H_5)_2)_3$, and said metal oxide film is tantalum oxide.

21. (Previously Presented) The method of claim 19, wherein said oxygen source is O_2 gas.

22. (Previously Presented) The method of claim 19, wherein said metal source includes at least one said compound selected from the group consisting of $Hf(NCH_3)_2)_4$, $Hf(N(C_2H_5)(CH_3))_4$ and $Hf(C_2H_5)_2)_4$, and said metal oxide is hafnium oxide.

23. (Previously Presented) The method of claim 19, wherein said metal source includes at least one said compound selected from the group consisting of $NbCl_5$, NbF_5 and $Nb(N(C_2H_5)_2)_3$, and said metal oxide is niobium oxide.

24. (New) A method for forming a semiconductor device comprising the steps of:

forming a bottom electrode having thereon hemi-spherical grains;
forming a silicon nitride film on said bottom electrode by using a rapid thermal nitration technique;
forming a capacitor insulator film on said silicon nitride film; and

Appl. No. 10/808,193

forming a top electrode on said capacitor insulator film, said capacitor insulator film forming step including:

providing oxidizing gas to bind oxygen atoms onto a surface of said silicon nitride film;

depositing a monoatomic film including a metal, by using an atomic layer deposition technique using a source gas including said metal, onto said silicon nitride film bound with said oxygen atoms; and

forming, subsequent to said depositing step, a metal oxide film including oxide of said metal on said monoatomic film by using a CVD technique.

25. (New) A method for forming a semiconductor device comprising the steps of:

forming a bottom electrode having thereon hemi-spherical grains;

forming a silicon nitride film on said bottom electrode by using a rapid thermal nitration technique;

forming a capacitor insulator film on said silicon nitride film; and

forming a top electrode on said capacitor insulator film, said capacitor insulator film forming step including:

providing oxidizing gas to bind oxygen atoms onto a surface of said silicon nitride film;

depositing a monoatomic film including a metal, by using an atomic layer deposition technique using a source gas including said metal, onto said silicon nitride film bound with said oxygen atoms;

oxidizing said monoatomic film to form a metal oxide film including said metal; and

depositing another metal oxide film including oxide of said metal onto said metal oxide film by using a CVD technique.